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(54) Sheet corner transfer.

(57) The disclosure relates to a sheet spreader for a sheet feeder apparatus comprising, at least one pair of sheet clamps (28), guideway means (60) to extend along an entry to a sheet feeder, means (61) to mount the clamps on the guideway means for movement along the entry to the sheet feeder and a plurality of sheet loading stations (18) located at fixed positions (A, B & C) opposite the guideway means. Each loading station has sheet clipping means (30, 31) to receive and support a pair of corners of a sheet and means (37, 38) to effect transfer of the sheet corners from the clipping means to the pair of sheet clamps (28) on the guideway means when the clamps are located in a transfer position adjacent said loading station. Drive means (3, 63) to move the sheet clamps (28) of said pair independently of one another first together in a transfer position at a respective loading station (18) and then apart to spread the sheet received at a loading station for entry to the sheet feeder (10).

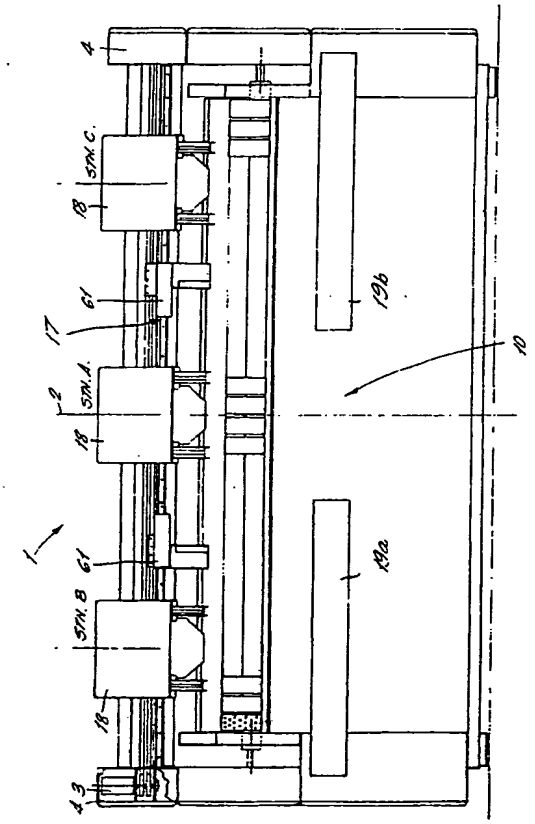

FIG. 1.

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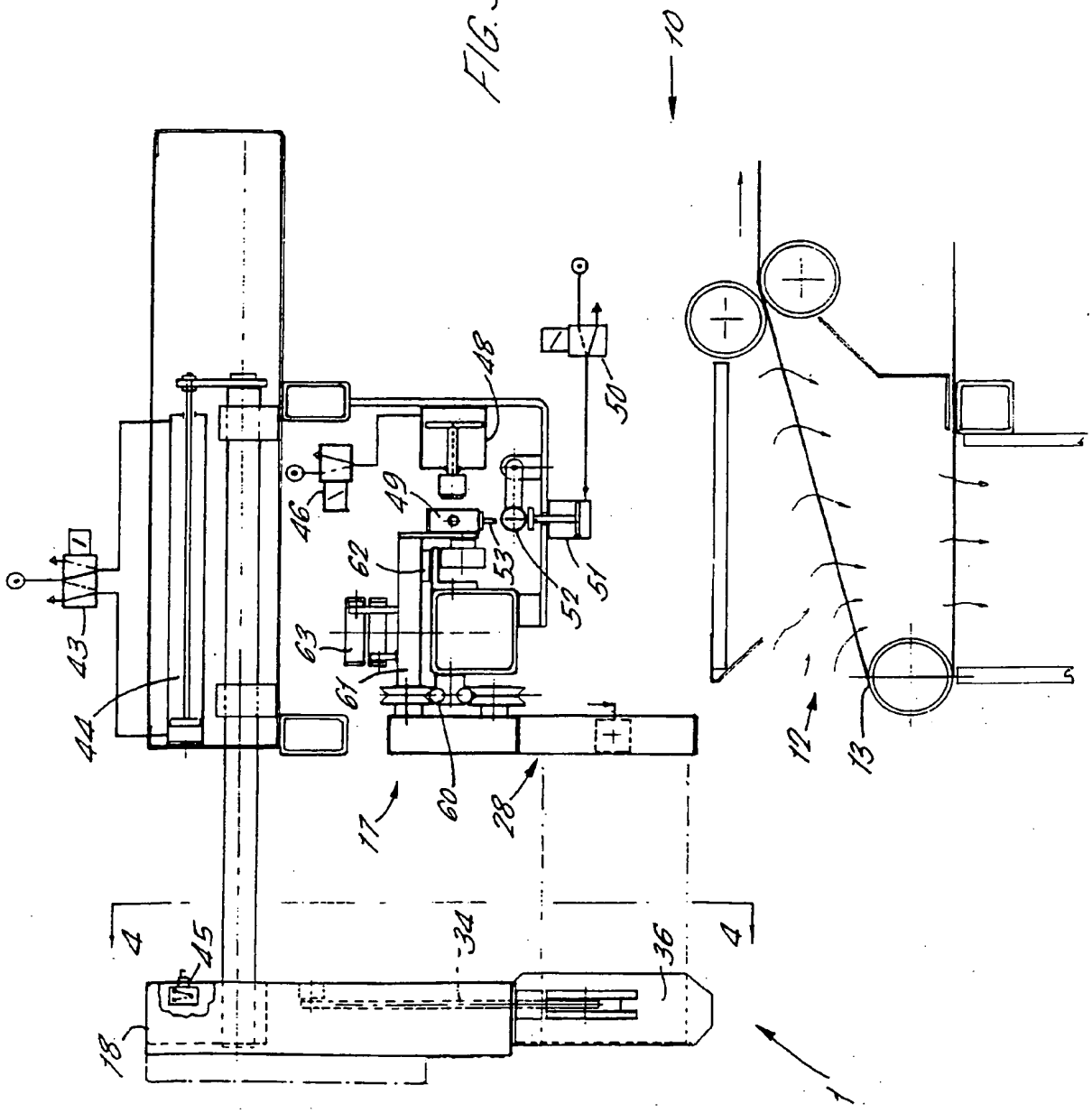
FIG. 3.



The invention relates to spreader feeding machines for laundry and textile sheet fabric materials. Such machines are well known in the industry and over a number of years many various designs and types have been available to the markets.

The machines which concern the invention are those where an operator manually loads the corners of an article such as a sheet or table cloth into a clipping mechanism which in turn transfers the loaded corners to a clamping and spreading mechanism which will spread and tension the leading edge of the sheet prior to it being fed onto the conveyor of the feeding machine for onward conveying to other processing equipment. Such machines are described in the following patent specifications: U.K. Nos. 1105901, 1169513 and US 3664046.

Production speeds of modern laundry processing equipment (such as ironing and folding machines) have risen significantly and a single operator cannot load the sheet corners to match current production requirements.

According to the known state of the art described in the above mentioned patents the loading and transfer of the sheet corners present undesirable limitations. The clamping and spreading means are arranged to move inward and outward from a fixed central feed line position and the clip means must be movable to this position in order to transfer the sheet corners. A critical mechanical movement is then necessary to pick and remove the top edge corners of the sheet by the clamp means. The loading positions where multi-operator usage can be effectively employed is limited to the practical mechanics of the positioning movements of the clip means to the central transfer position.

A further limitation is the portion of the corner which is actually gripped by the clamp. This is a relatively small area of the top edge of the sheet and consequently limits the amount of desirable tensioning force which can be exerted to spread the leading edge of the sheet without causing damage and tearing of the fabric. Outward spreading speeds and forces must therefore be restricted to prevent such damage occurring.

An object of the present invention is to provide the high speed transfer of the corners of a sheet from a loading position to a clamping and spreading position with means to spread and tension the leading edge in preparation for onward feeding.

More specifically the purpose of the invention is to provide improved means for clip loading the corners of a sheet, coupled with a faster means to transfer the loaded corners from the clips to the clamps together with high speed spreading and tensioning of the leading edge portion of the sheet in preparation for the onward feeding process.

This invention provides a sheet spreader for a sheet feed apparatus comprising at least one pair of sheet clamps to receive lengths of side edges of a sheet adjacent an end of the sheet to be spread, means to move the clamps between adjacent locations at a transfer position to receive said sheet edges and spaced apart locations to spread the sheet therebetween, clipping means at a loading station to suspend said end of a sheet adjacent the corners thereof with said adjacent side edges of the sheet located for transfer to said clamps, means to effect the transfer of said side edge portions of the sheet to said clamps in the transfer position and to release the clipping means to allow the sheet to be spread and tensioned by the clamps for entry to the sheet feed apparatus.

Preferably the sheet clipping means holds the sheet end suspended whilst said side edge portions are transferred to the clamps and the clipping means are released when the side edge portions are engaged by the clamps.

The arrangement of this aspect of the invention enables the sheet clamps to receive and hold a significant length of the side edge corner portions of the sheet (e.g. 120 to 200 mm) so that the sheet is not unduly stressed by the spreading and tensioning forces of the sheet clamps. It will be understood that the length of side edge gripped in the clamp controls the amount of tension which can be applied without damaging the fabric.

The invention also provides a sheet spreader for a sheet feeder apparatus comprising, at least one pair of sheet clamps, guideway means to extend along an entry to a sheet feeder, means to mount the clamps on the guideway means for movement along the entry to the sheet feeder, a plurality of sheet loading stations located at fixed positions opposite the guideway means, each loading station having sheet clipping means to receive and support a pair of corners of a sheet and means to effect transfer of the sheet corners from the clipping means to the pair of sheet clamps on the guideway means when the clamps are located in a transfer position adjacent said loading station and means to move the sheet clamps of said pair independently of one another first together at in a transfer position at a respective loading station and then apart to spread the sheet received at a loading station for entry to the sheet feeder.

An important further aspect of the invention is the ability to provide a number of independent fixed loading positions at convenient locations along the guideway to permit the employment of multiple operator usage to match the production needs.

Preferably means are provided for mounting the clipping means of the or each loading station for movement between a sheet receiving position remot from the sheet clamps and a sheet transfer position in which the

sheet corners held by the clips are transferred to the sheet clamps.

In one arrangement according to the invention the means for moving the clipping means between said receiving and said transfer positions act in a general horizontal direction.

In a further arrangement according to the invention the means for moving the clipping means between said receiving and said transfer positions act in an inclined direction from a lower loading position at a convenient level for an operator and to an upper transfer position to present the sheet end to the clamps and in so doing to lift at least a proportion of the body of the sheet from the ground to facilitate spreading of the sheet.

In any of the above arrangements the clipping means may include means for displacing said side edge portions of the sheet into the clamps whilst the sheet is suspended by the clipping means.

For example the means for displacing said side edge portions of the sheet supported by the clipping means into the clamps may comprise air jet means.

In one particular arrangement according to the invention the clipping means may comprise a pair of vertically extending sheet support members mounted side by side one another to face the sheet clamps when the latter are in the transfer position, releasable sheet clips acting on the adjacent faces of the members to hold the end of the sheet adjacent the corners on the members, means on the remote sides of the members to support the corner portions of the sheet laid against the members facing towards the clamps and air jet means on the members directed towards the clamps in the transfer position thereof to displace the side edge portions of the sheet laid on the members into the clamps when the latter are in said transfer position.

More specifically the members may be of hollow box form having an elongate slit extending down the sides of the members facing the clamps in the transfer position and means being provided for supplying air under pressure to the hollow members to issue as an elongate jet from the slit to blow the sheet side edge portions laid against the members into the clamps.

According to a further feature the means for retaining the side edge portions of the sheet laid against the elongate members of the clipping means may comprise presser elements biased against the remote sides of the support members to hold the side edge portions of the sheet against the members with a relatively light pressure and means are provided to relieve the presser members to allow release of the side edge portions of the sheet for transfer into the clamps.

In a further arrangement according to the invention the clipping means may include a pair of elongate vertically extending flexible tongues which the sheet edge portions may be wrapped around, the tongues being moved into the sheet clamps by said movement of the clipping means which act to grip and remove the sheet edge portions from the tongues when the latter retract with the clipping means leaving the sheet edge portions retained by the clamps.

In any of the above arrangements guide means may be provided to guide the sheet clamps along a predetermined path to receive and spread sheets and one or more clipping means are provided at a convenient fixed location or locations along the path to provide one or more sheet transfer positions at which sheets to be spread for entry to a sheet feed apparatus may be located.

More specifically the means to move the clamps between said adjacent and spaced positions may comprise an elongate guideway, at least one pair of carriages for the respective clamps mounted on the guideway and independent drive means to move the carriages together at said loading station to present the clamps for receipt of a pair of corner portions of a sheet and to move the carriages apart to spread the sheet. The drive means for moving the carriages along the track may comprise motor driven endless belts extending the length of the track and connected to the respective carriages and the motor drives for the carriages have torque sensitive controls for stopping the motors when the torque delivered by the motors reaches a predetermined amount indicating that the sheet has been spread to its fullest extent. Spreading of the sheet could also be detected by a photo-cell system to provide a beam which is broken by drawing the top edge of the sheet substantially straight. The torque responsive controls may include means for effecting a small reversal of the motors after the torque has reached said predetermined level to release the tension imposed on the sheet by spreading the sheet.

According to a further feature of the invention the sheet clamps may be pneumatically operated having air inlets to communicate with a source of air pressure facing transversely of the path of movement of the clamps, and an air pressure supply is provided having a pair of spaced nozzles located side by side at the transfer station to register with the clamp inlets and means are provided to move the nozzles into and out of engagement with the clamp inlets to supply air thereto for operating the clamps.

More sp cifically the means to move the nozzles may comprise a ram operated carrier for the nozzles and the air supply for the nozzles also supplies the carrier ram.

The pneumatically operated clamps may have valve means to retain air pressure therein to maintain the clamps clos d and pressure release means to allow the clamps to open and separate means are provided extending along the path of movement of the clamps and operable to actuate the pressure release means when

the clamps reach their spread positions.

It will be appreciated that the invention is applicable to a number of different forms of sheet feeders and sheet clamping arrangements. The arrangements described in the following patent specifications are particularly suitable:

F eders: European No. 0153069 dated 28th August 1991
U.S.A. No. 4 729 181 dated 8th March 1988
U.S.A. No. 4 967 495 dated 6th November 1990
European Appln. No. 0345087 dated 2nd June, 1989

Clamping: U.S.A. No. 499326 dated 12th February 1991
European Appln. No. 0341084 dated 5th May 1989.

It will of course be understood that the invention can be also used in conjunction with other feeding machines and clamping arrangements.

The following is a description of some specific embodiments of the invention, reference being made to the accompanying drawings in which:

Figure 1 is a front elevation of a sheet feeder embodying a sheet spreader in accordance with the invention;
Figure 2 is a sectional side elevation view of the sheet feeder/sheet spreader;
Figure 3 is a sectional side view of the sheet spreader and part of the sheet feeder showing the arrangement in greater detail;
Figure 4 is a section on the line 4-4 on Figure 3;
Figure 5 is a section on the line 5-5 on Figure 4;
Figure 6 is a sectional plan view of one sheet clamp and one sheet clip of the sheet spreader at the transfer station;
Figures 7 and 8 illustrate a sheet suspended from the sheet spreader in bunched and spread conditions with the areas on the sheet end engaged by the sheet clips indicated;
Figure 9 shows the arrangement for supplying air pressure to the pneumatically operated sheet clamps of the spreader;
Figures 10 and 11 illustrate the valve arrangement for retaining air pressure in the sheet clamp;
Figure 12 illustrates the mechanism for releasing air pressure from the sheet clamps;
Figure 13 is a similar view to Figure 9 showing an arrangement for supplying air pressure to pairs of sheet clamps at three transfer stations at spaced locations along the entry to a sheet feeder;
Figures 14, 15 and 16 are diagramatic illustrations showing sheet clipping and spreading at three different transfer locations spaced along the entry to the sheet feeder;
Figures 17 and 18 illustrate control systems of the apparatus.
Figure 19 is a diagramatic view of a first alternative form of sheet clamp and sheet clip showing the stages of clipping and transfer in sequence;
Figure 20 is a diagramatic view of a second alternative form of clip and clamp showing step by step sheet clipping and transfer to the sheet clamp; and
Figure 21 shows a modified form of load station.

Referring firstly to Figures 1 and 2 of the drawings, a sheet spreader according to the invention is shown indicated generally at 1 installed on a sheet feeder indicated generally at 10 and constructed in accordance with the principals described and illustrated in European patent specification no. 0153069 and U.S. patent specification no. 4729181. The feeder includes a housing 11 through which the multiple belt form conveyor 12 extends having a receiving end indicated generally at 13 and a delivery end indicated at 14.

The housing 11 has an entry 15 extending along the length of the conveyor through which spread sheets are drawn by vacuum drawn within the housing onto the feed end of the conveyor to be fed by the conveyor through the housing and to an ironer or other laundry processing equipment.

The sheet spreader 1 supports a sheet 16 to be received by the feeder drapped across the entry to the housing suspended from clamps mounted on a linear horizontally extending track mechanism extending along the housing above the entry as indicated at 17. Sheets to be processed are temporarily supported on one of three loading stations 18, one positioned at A in the spreader centre line 2 with the other loading stations disposed on either side of the centre line at B and C. Each loading station has a pair of clipping mechanisms for temporarily holding the corners of a sheet for transfer to the sheet clamps and then to be spread apart along the entry to the housing as described in detail below. After spreading, the leading edge of the sheet is drawn by vacuum created in the housing into the housing and onto the feed end of the conveyor which then draws the sheet through the housing and delivers it to the ironer as described in detail in the European and U.S. patent specifications referred to above.

Below the entry to the housing left and right hand pairs of spreader belts 19a and 19b are provided spaced apart one either side of the spreader centre line 2 to permit passage of a bunched sheet between the pairs of

belts prior to spreading. The edges of the sheet are drawn between the belts by the separation of the clamps so that the body of the sheet is spread out by the spreader belts as the sheet is drawn through the belts to ensure that the sheet is laid on the conveyor in a flat condition without creases or wrinkles.

Figures 3 to 8 shows details of a loading station 18 and its location in relation to the spreader clamps 17 and the feeding machine conveyor 12. The loading station has a spaced pair of downwardly extending clip bodies 36 and a main pair of clips 30 operated by air cylinders 31 in response to activation of switch sensors 32 acting on the inner sides of the clip bodies. When the top edge of a sheet corner is inserted into the open mouth of a clip 30, valve 33 supplies air pressure to the clip cylinder which closes the clip to hold the top edge of the sheet as indicated at 21 on Figure 8 adjacent the sheet corner against the clip body 36. A subsidiary pair of clips act on the outer sides of the clip bodies each comprising a lightly spring loaded lever 34 with a smooth shoe 35 attached to the end provides the location hold of the side edge of the sheet corner, indicated at 22 on Figure 8, against the clip body 36. Manual loading is executed by laying the corners of the sheet 20 around the lower portions of the clip bodies 36 and then sliding the corners up the bodies to engage said top edge portions 21 in the clips 30 and to locate the side edge portions 22 under the shoes 35.

Reference is now made to Figures 7 and 8 of the drawings which show a sheet 20 in bunched and spread conditions. The shaded areas 21 indicate the top edge portions of the corner which are held by the main clips 30. The shaded portions 22 are the side edges which are temporarily held by the subsidiary clips 34, 35 before transfer to the spreader clamps. The leading edge of the sheet 23 is spread and tensioned by the spreader clamps as described below.

Each clip body 36 houses air jet tubes 37 which are arranged to blow through the aperture 38 (see Figure 6) and transfer the sheet corner into the jaws of the clamps. A venturi shaped liner 39 and a slotted opening 40 in the front of the clip body causes atmospheric air to be drawn into the body when the air jets are triggered. This results in an increased volume and spread of the air blow and also reduces the directional intensity of the high pressure air jets. Compressed air is fed to both air jet tubes by the valve 41. This valve also feeds air to the air cylinders 42 which lift the location shoes 35 and release the side edge corners for transfer into the clamp jaws. These operations all occur simultaneously in approximately 80 milli-seconds which is the time it takes to execute the sheet corner transfer into the spreader clamps.

The load station sequences are initiated when both the switching sensors 32 are activated by the presence of the two sheet corners in the clips 30. These signals are stored in a micro-processor control system and dealt with in order of loading. Servo drives 3 (see Figure 1) are independently directed to position the spreader clamps adjacent to the load station position to be transferred. The processor outputs a signal to valve 43 which activates the air cylinder 44 which in turn positions the load station into the proximity of the spreader clamps 17. The initiation of switch 45 on the load station by its contact with the support frame for the load station signals to the processor that the station is in the transfer position. Valve 41 is then triggered together with valve 46. The air jets blow the corner of the sheet into the clamp jaws. The jaw closing cylinders 47 of the clamps are activated by compressed air via the injector cylinder 48 and non-return valve 49. The sheet corners are thus transferred and held in the clamps. The processor then deactivates valves 33 and 46. The clips release their hold on the corners which drop out. The injector cylinder 48 retracts from its contact with the non-return valve 49. Valve 43 is deactivated and the load station retracts to the loading position. The servo motors are then activated to move the spreader clamps to a central feed portion and then spread and tension the leading edge of the sheet. When the preset spreading and tensioning torque value is sensed by the servo drive system the processor initiates a small reversal movement of the motors partially to relax the tension in the leading edge of the sheet. The suction feed under the feeding machine conveyor 12 is activated simultaneously with a brief activation of valve 50 which initiates the clamp release air cylinder 51 which in turn moves the release bar 52 (see Figure 12) to depress the actuator plungers 53 of the non-return valve 49 and exhaust the air from the clamp cylinder 47, thereby opening the clamp jaws to release the sheet to the feeding machine conveyor.

It will be appreciated that other forms of motor may be used instead of the servo motors referred to for the belt drives. For example, stepper motors or braked motors responsive to sensors placed along the guideway could be utilised.

The spreader just described is applicable to the feeding system disclosed in European Patent No. 0153069 or, alternatively to he feeding system described in European Patent Publication No. 0345087.

The sheet spreading mechanisms are housed in a bridge structure 55 comprising three support beams terminating in two side frame boxes (not shown). This structure spans above and across the feeding machine conveyor 12.

The clamps 28 are attached to a pair of wheeled carriages 61 running on a track 60 and a second stabilising track 62 and, as shown in Figure 1, are driven by two servo motors 3 located in the side frame boxes 4. Power is transmitted to each carriage by endless toothed belts 63. The 2 axis servo motor drives 3 are micro processor controlled. The processor control can be programmed to locate or move the carriages to any required position

along the track. Spreading torque values for tensioning the leading edge of the sheet can also be programmed by setting appropriate motor current supply. It is also possible to extend the length of the bridge and tracks to position two pairs of clamps and carriages incorporating a 4 axis servo drive system. This will permit the effective use of up to six loading stations to support very high production requirements.

Figure 6 is a diagrammatic plan of the clipping mechanism and clamp mechanism with pneumatic control circuits. This diagram shows the sheet corner being blown into the clamp jaws. Clip position 'A' is the loading point. Position 'B' is the transfer point. The corner of the sheet is held in the clamp 28 with a doubled over edge. This edge is automatically drawn out by the suction effect of the feeding operation.

Figure 9 is a diagrammatic detail showing how air pressure is fed to the air cylinders of the clamps in the transfer position. When the spreader carriages 61 are moved to the transfer position, the non-return valves 49 are lined up with the air injection cylinder 48 and its double outlet nozzle 64. Actuation of valve 46 feeds compressed air into the injector cylinder 48, which thrusts the nozzle seals 65 over the port holes 66 in the non-return valve bodies 49. The air then feeds through the non-return valve and activates the clamp cylinder 47, thereby closing the clamp jaws. The nozzle is retracted when valve 46 is deactivated and the air pressure is trapped in the clamp cylinder until the actuator plunger 53 of the non-return valve 49 is depressed by the release bar 52, when the trapped air is exhausted and the clamp jaws open.

Figures 10 and 11 show the non-return valve 49 which comprises a block body 70, a neoprene ball 71, a release plunger 53, compressed air feed entry port 72 and an air outlet port 73 to clamp 30. The ball 71 only permits one way flow of the air until it is lifted off its seat by the plunger when air is exhausted back through port 72.

Figure 13 shows the pneumatic arrangement for the three loading stations of the spreader for injecting air into the clamp cylinders. This circuit can easily be extended for any multiple number of loading stations as referred to above.

The basic control sequences of the micro processor control for the preferred application to a sheet feeder using the principles described in European Patent No. 0153069 are as follows with reference to the sequence of operations illustrated in Figures 14 to 16 and the block diagram of Figure 17 showing the essential elements of the control circuit and flow diagram of Figure 18:

1. On initial start up of machine, the servo drives 3 moves the spreader carriages 61 along the track to home positions where contact with sensors 101 input signals to the processor 100 to synchronise the servo positional systems.

2. Input signals from the respective loading stations indicate when both corner clips at each station have been loaded with a sheet to be delivered to the feeder and are therefore in a "ready" state. These signals are stored in the memory of the processor and are dealt with in order of station loading.

3. Processor directs the servo drives to position the two spreader carriages independently at the next "ready" state load station. For air jet transfer systems, the load station is also simultaneously moved into the transfer position ready for transfer.

4. When both carriages and load station are in position, the processor makes output signals to release the outer, subsidiary corner clips, to operate the air jet transfer and to close the clamp jaws via the air injection valves - followed by another output which releases the inner, main corner clips and retracts the station to disengage from the clamps. When the main corner clips open, the top edge drops out of the clips under gravity leaving the sheet transferred to and gripped along its side edges by the spreader clamps.

5. Processor then signals servo drives to commence the sheet spreading sequence; which proceeds as follows:

If the load station from which the sheet has been received is one of the two stations not on the centre line of the spreader apparatus the two carraiges first move in tandem to the centre line to pass the sheet between the adjacent ends of the left and right hand spreader belt system which the side edges of the sheet are fed into as the sheet is spread. Once the carriages reach the centre line or if they are already at the centre line having received a sheet at the central loading station, they then separate in opposing directions to spread and tension the sheet.

6. When the selected tension across the sheet is sensed by the processor, the servo drives are automatically braked. The processor then proceeds with the corner release sequence as follows:

The servo drives for the spreader carriages are reversed inward for a short distance to relax tension. The suction feeding duct of the feeding machine is opened and simultaneously the corner clamps are opened by exhausting the air pressure which was injected to close them. The leading edge of the sheet is released and is sucked into the feeding machine and onto the conveyor. From this point on, the sheet is under the control of the feeding machine and the sequence to collect and feed the next sheet will recommence the sequence described. The micro processor program controlling the servo motor drive system is state of the art technology. The precise location of both the spreader carriages and their clamps are known

at all stages of the operation and can be independently positioned at any point along the run of the track.

The spreader and transfer described are as programmed for a preferred feeding machine. It will, of course, be understood that the spreader is suitable for other forms of feeders. Alternative sequences can be programmed to suit various machines and also for the other forms of transfer clip mechanisms such as the blade insert mechanism shown in Figure 20 and referred to later or a clip mechanism such as that shown in U.K. Patent No. 1169513.

Whilst three loading stations have been illustrated, it will be understood that four or more loading stations could be provided or just two stations could be used. In addition, two pairs of clamps could be provided, having separate motor driven endless belt drives to supply two parallel lanes of the feeder, i.e. a four axis arrangement, or to feed one lane with an extended width track with two pairs of clamps so that when one pair of clamps is at one end of the spreader track to receive a sheet, the other pair is spreading a sheet and vice versa.

Further forms of clip/clamp mechanisms are illustrated in Figures 19 and 20 of the drawings. The arrangement of Figure 19 utilises an air jet to direct the sheet edge portion from the clip into the clamp whereas the arrangement of Figure 20 provides a clip having flexible walled channel one side of which enters the clamp in the transfer position to allow the sheet edge wrapped over the wall to be gripped and relaxed by the clamp when the clip retracts as illustrated.

Reference is now made to Figure 21 of the drawings which illustrates a modification to the load station 18 and like parts have been allotted the same reference numerals. The main difference is that the horizontal movement of the station between loading and transfer positions is modified to extend in an upwardly angled direction from the sheet receiving or loading position A to an elevated transfer position B. By locating guideway and sheet clamps at an elevated position a greater proportion of the sheet to be spread is lifted off the ground or being raised by the loading station for transfer to the clamps and this makes the sheet move readily spread for entry to the feeder. Preferably the lower receiving position is adjustable in level for ergonomic reasons. The adjustment is provided by an end stop determining the lower position or by adjustment of the stroke of the cylinder which moves the loading stations up and down.

Claims

1. A sheet spreader for a sheet feed apparatus comprising at least one pair of sheet clamps to receive lengths of side edges of a sheet adjacent an end of the sheet to be spread, means to move the clamps between adjacent locations at a transfer position to receive said sheet edges and to spaced apart locations to spread the sheet therebetween, clipping means at a loading station to suspend said end of a sheet adjacent the corners thereof with said adjacent side edge portions of the sheet located for transfer to said clamps, means to effect the transfer of said side edge portions of the sheet to the clamps in the transfer position and to release the clipping means to allow the end of the sheet to be spread by the clamps for entry to the sheet feed apparatus.

2. A sheet spreader as claimed in Claim 1, wherein the sheet clipping means holds the sheet end suspended whilst said side edge portions are transferred to the clamps and the clipping means are released when the side edge portions are engaged by the clamps.

3. A sheet spreader for a sheet feeder apparatus comprising, at least one pair of sheet clamps, guideway means to extend along an entry to a sheet feeder, means to mount the clamps on the guideway means for independent movement along the entry to the sheet feeder, a plurality of sheet loading stations located at fixed positions opposite the guideway means, each loading station having sheet clipping means to receive and support a pair of corners of a sheet and means to effect transfer of the sheet corners from the clipping means to the pair of sheet clamps on the guideway means when the clamps are located in a transfer position adjacent said loading station and means to move the sheet clamps of said pair independently of one another first together in a transfer position at a respective loading stations and then apart to spread the sheet received at a loading station for entry to the sheet feeder.

4. A sheet spreader as claimed in Claim 3, wherein the clamp moving means moves the clamps from said loading station in tandem to a central location along the guideway before the clamps are moved apart to spread the sheet.

5. A sheet spreader as claimed in any of Claims 1 to 4, wherein means are provided for mounting the clipping

means of the or each loading station for movement between a sheet receiving position remote from the sheet clamps and a sheet transfer position in which the sheet corners held by the clips are transferred to the sheet clamps.

6. A sheet spreader as claimed in Claim 5, wherein the means for moving the clipping means between said receiving and said transfer positions act in a general horizontal direction.

7. A sheet spreader as claimed in Claim 5, wherein the means for moving the clipping means between said receiving and said transfer positions act in an inclined direction from a lower loading position at a convenient level for an operator and to an upper transfer position to present the sheet end to the clamps and in so doing to lift at least a proportion of the body of the sheet to facilitate spreading of the sheet.

8. A sheet spreader as claimed in any of the preceding claims, wherein the clipping means include means for displacing said side edge portions of the sheet into the clamps whilst the sheet is suspended by the clipping means.

9. A sheet spreader as claimed in Claim 7, wherein the means for displacing said side edge portions of the sheet supported by the clipping means into the clamps comprise air jet means.

10. A sheet spreader as claimed in Claim 9, wherein the clipping means comprise a pair of vertically extending sheet support members mounted side by side one another to face the sheet clamps when the latter are in the loading station, releasable sheet clips acting on the adjacent faces of the members to hold the end of the sheet adjacent the corners on the members, means on the remote sides of the members to support the corner portions of the sheet laid against the members facing towards the clamps and air jet means on the members directed towards the clamps when in the loading station thereof to displace the side edge portions of the sheet laid on the members into the clamps when the latter are in said transfer position.

11. A sheet spreader as claimed in Claim 10, wherein the members are of hollow box form having an elongate slit extending down the sides of the members facing the clamps in the transfer position and means being provided for supplying air under pressure to the hollow members to issue as an elongate jet from the slit to blow the sheet side edge portions laid against the members into the clamps.

12. A sheet spreader as claimed in Claim 10 or Claim 11, wherein the means for retaining the side edge portions of the sheet laid against the elongate members of the clipping means comprise presser elements biased against the remote sides of the support members to hold the side edge portions of the sheet against the members with a relatively light pressure and means are provided to relieve the presser members to allow release of the side edge portions of the sheet for transfer into the clamps.

13. A sheet feeder as claimed in any of Claims 5 to 7, wherein the clipping means includes a pair of elongate vertically extending flexible tongues which the sheet edge portions may be wrapped around, the tongues being moved into the sheet clamps by said movement of the clipping means which act to grip and remove the sheet edge portions from the tongues when the latter retract with the clipping means leaving the sheet edge portions retained by the clamps.

14. A sheet spreader as claimed in Claim 13, wherein the drive means for moving the carriages along the track comprise motor driven endless belts extending the length of the track and connected to the respective carriages.

15. A sheet spreader as claimed in Claim 14, wherein the motor drives for the carriages are servo motors having torque sensitive controls for stopping the motors when the torque delivered by the motors reaches a predetermined amount indicating that the sheet has been spread to its fullest extent.

16. A sheet spreader as claimed in Claim 15, wherein the torque responsive controls includes means for effecting a small reversal of the motors after the torque has reached said predetermined level to release the tension imposed on the sheet by spreading the sheet.

17. A sheet spreader as claimed in any of the preceding claims, wherein the sheet clamps are pneumatically operated having air inlets to communicate with a source of air pressure facing transversely of the path of movement of the clamps, and an air pressure supply is provided having a pair of spaced nozzles located side by side at the transfer station to register with the clamp inlets and means are provided to move the

nozzles into and out of engagement with the clamp inlets to supply air thereto for operating the clamps.

18. A sheet spreader as claimed in Claim 17, wherein the means to move the nozzles comprises a ram operated carrier for the nozzles and the air supply for the nozzles also supplies the carrier ram.

19. A sheet spreader as claimed in Claim 17 or Claim 18, wherein the pneumatically operated clamps have valve means to retain air pressure therein to maintain the clamps closed and pressure release means to allow the clamps to open and separate means are provided extending along the path of movement of the clamps and operable to actuate the pressure release means when the clamps reach their spread positions.

20. The sheet spreader as claimed in Claims 1 or 3, wherein each of said clamps includes a pair of clamp jaws operable between open and closed pressure-receiving surfaces, a first pressure member movable into pressing engagement with and away from said first pressure-receiving surface and positioned to supportingly secure a first region of said upper extremities of said sheet spaced a given distance from a corner of said sheet when said first pressure member is urged towards said first pressure-receiving surface, a second pressure member movable into pressing engagement with said second pressure-receiving surface and positioned to supportingly secure a second region of the upper extremities of said sheet between said first region and the associated corner of an inserted sheet when said second pressure member is urged towards said second pressure-receiving surface, means for initially moving said second pressure member to a pressing position to supportingly engage said second region and said first pressure member to said pressing position to supportingly engage said first region of the sheet, sheet moving means for moving at least said second portion of said upper extremity of said sheet from behind said second pressure member and inserting the same between the jaws of the associated clamp while said first pressure member retains its grip on said sheet, and means for next moving said jaws to a closed position and then operating said first pressure member to a releasing condition.

21. The spreader as claimed in Claim 20, wherein said clipping means includes a support member having said first and second pressure-receiving surfaces on opposite sides thereof, said sheet moving means includes a source of gas under pressure oriented to force said second region of the upper extremities of said sheet between the jaws of the associated clamp upon operation of said second pressure member to a releasing condition.

22. The spreader as claimed in Claim 20, wherein said clipping means includes a support member having said first and second pressure-receiving surfaces on adjacent sides thereof, said sheet moving means having associated therewith a source of gas under pressure oriented to force said second region of the upper extremities of said sheet between the jaws of the associated clamp upon operation of said second pressure member to a releasing condition.

23. The spreader as claimed in Claim 20, wherein one jaw of each said clamp is configured as a vertically oriented rib, said clipping means includes a support member having a passage between said first and second pressure-receiving surfaces configured to accommodate insertion of said rib, and means for moving said support member between an initial withdrawn position with said rib disposed outside said passage and an advanced position wherein said rib extends into said passage, and means for moving said support member from said withdrawn to said advanced position during which movement said sheet is released from said second pressure member, means for next operating said jaws to a closed condition, and means for next operating said first pressure member to a releasing condition and said support member to said withdrawn position.

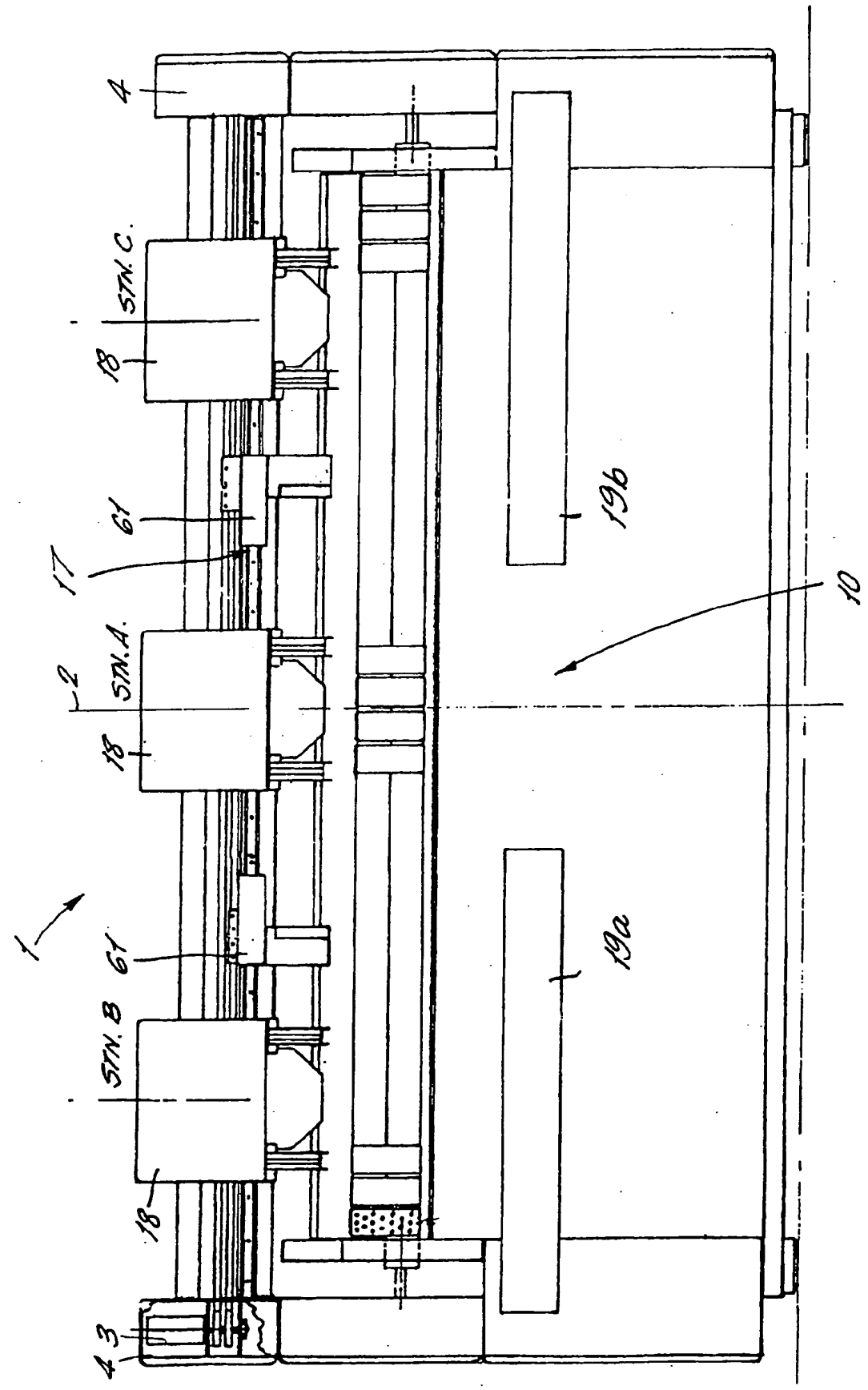


FIG. 1.

FIG. 2.

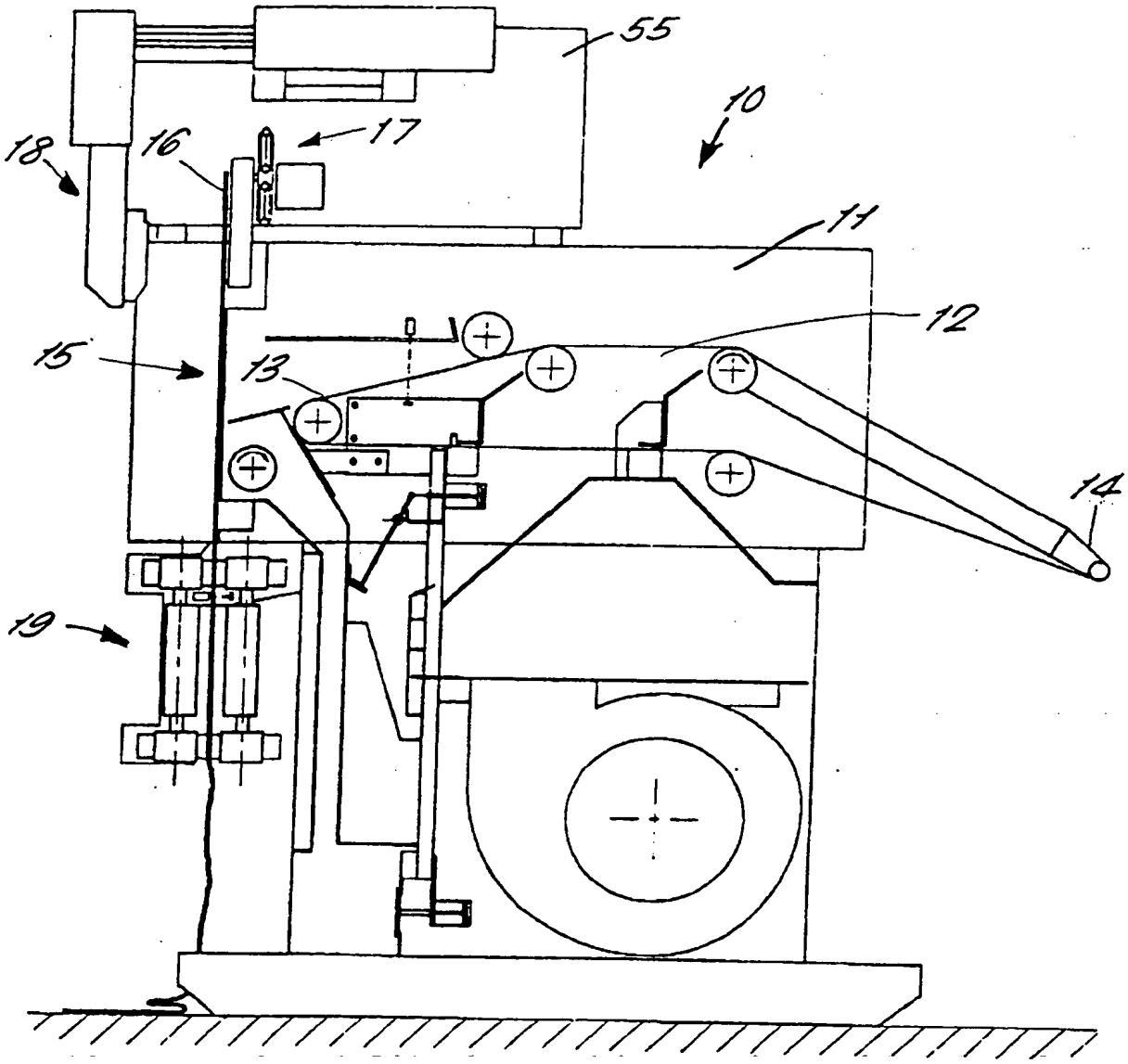


FIG. 3.

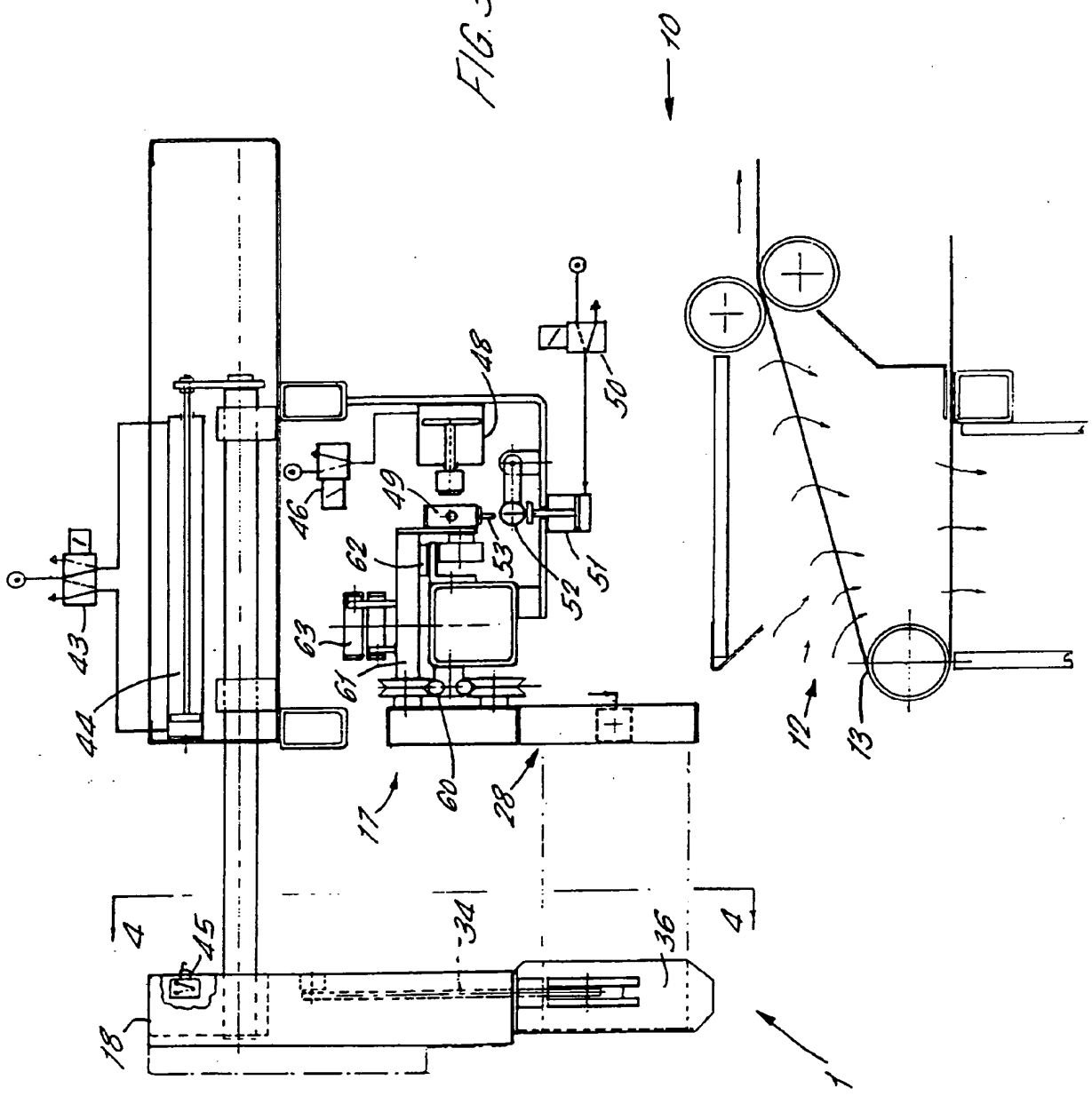


FIG. 4.

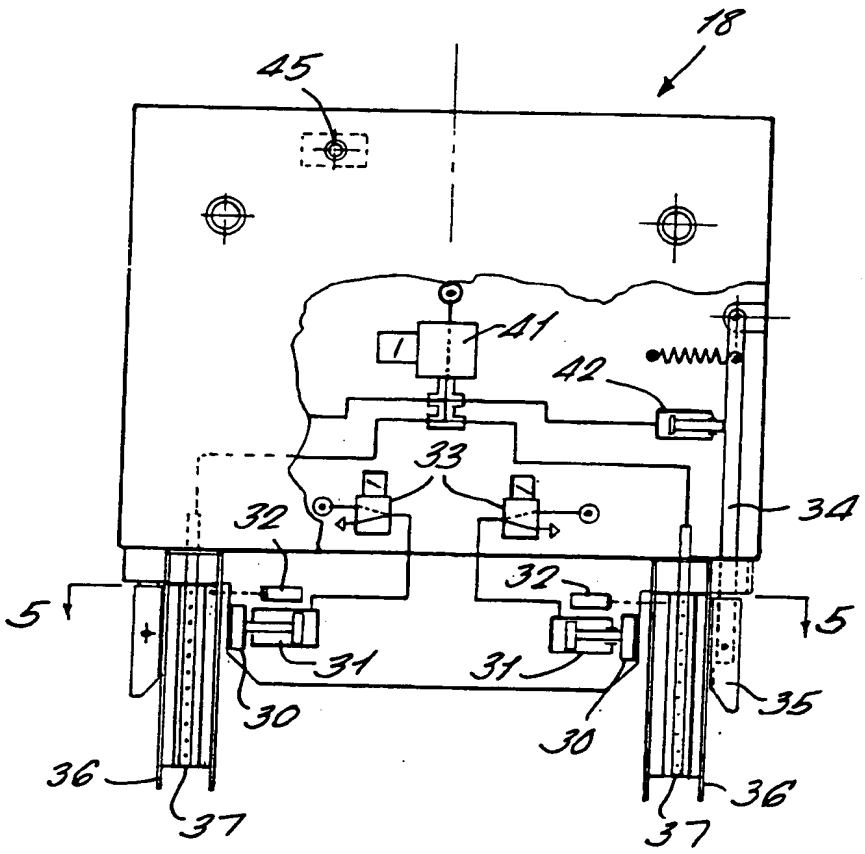
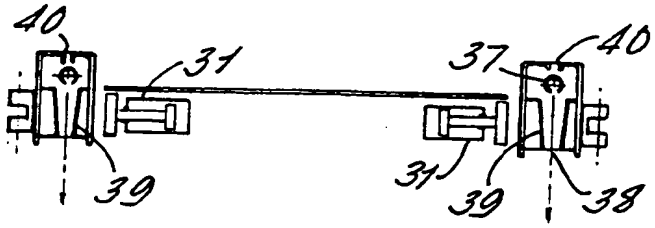


FIG. 5.



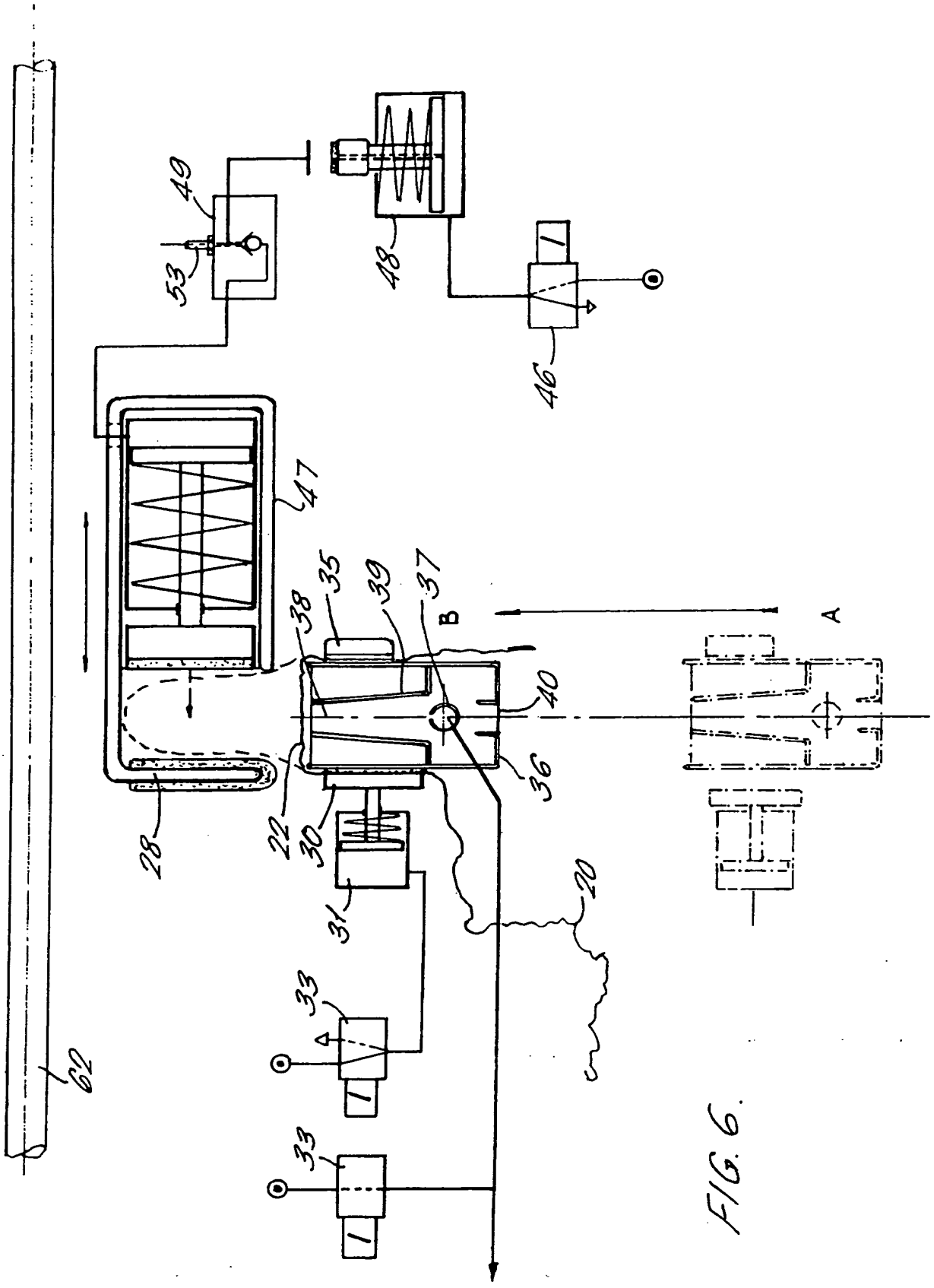


FIG. 6.

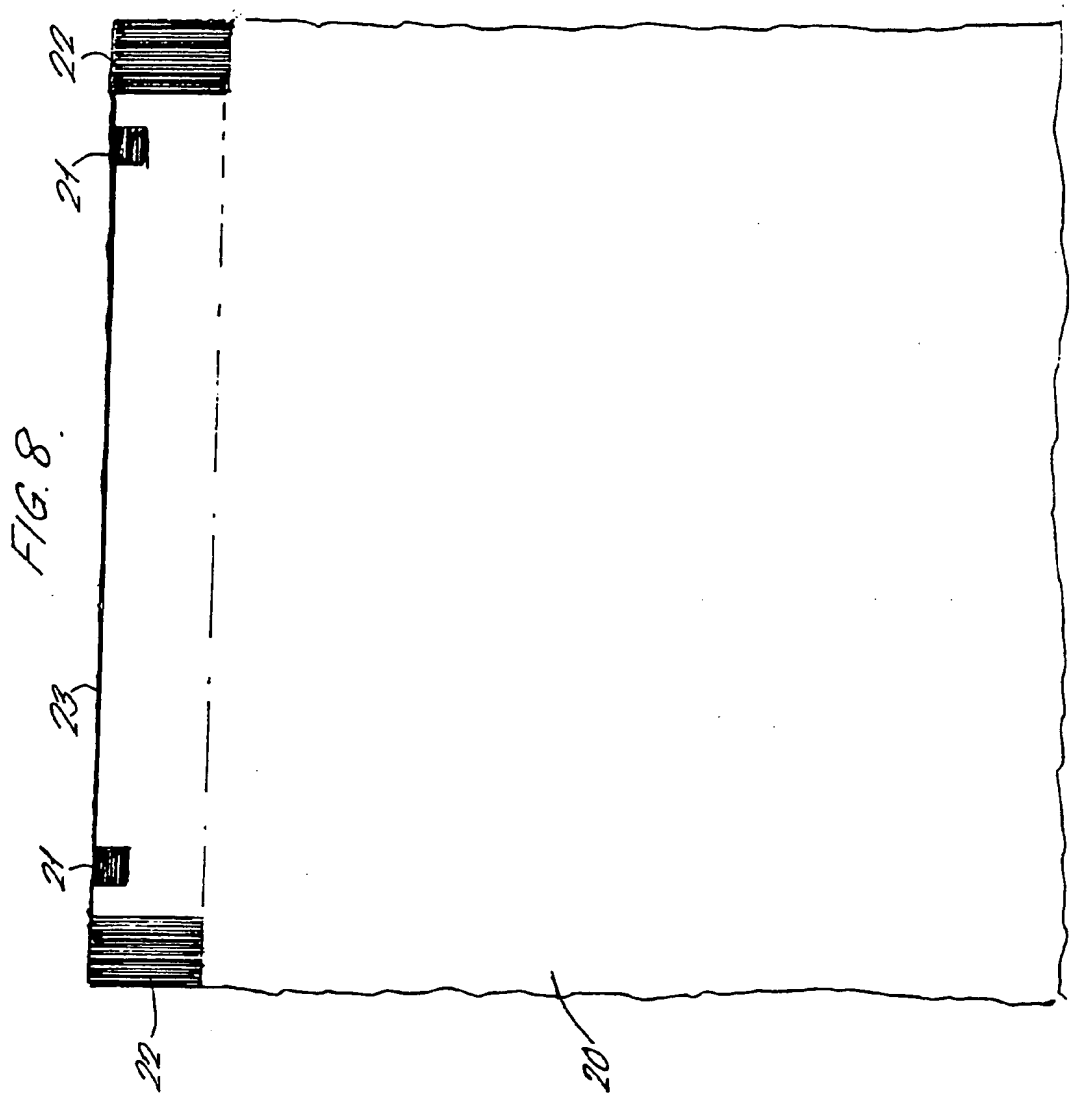


FIG. 8.

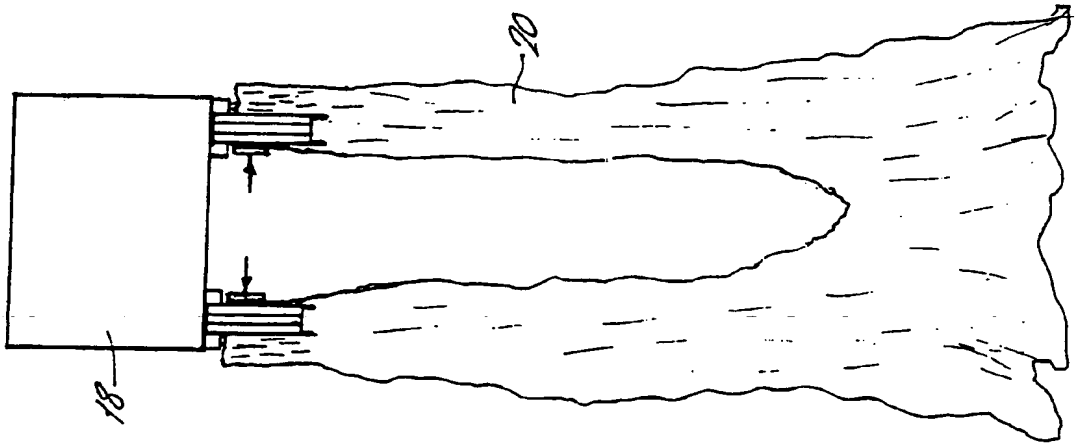


FIG. 7.

FIG. 12.

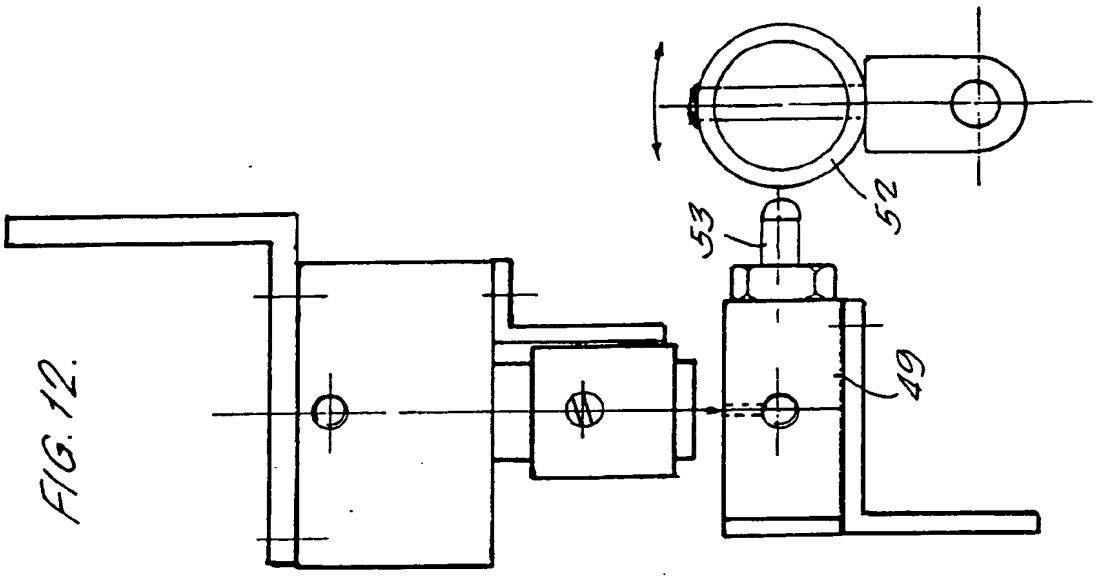


FIG. 9.

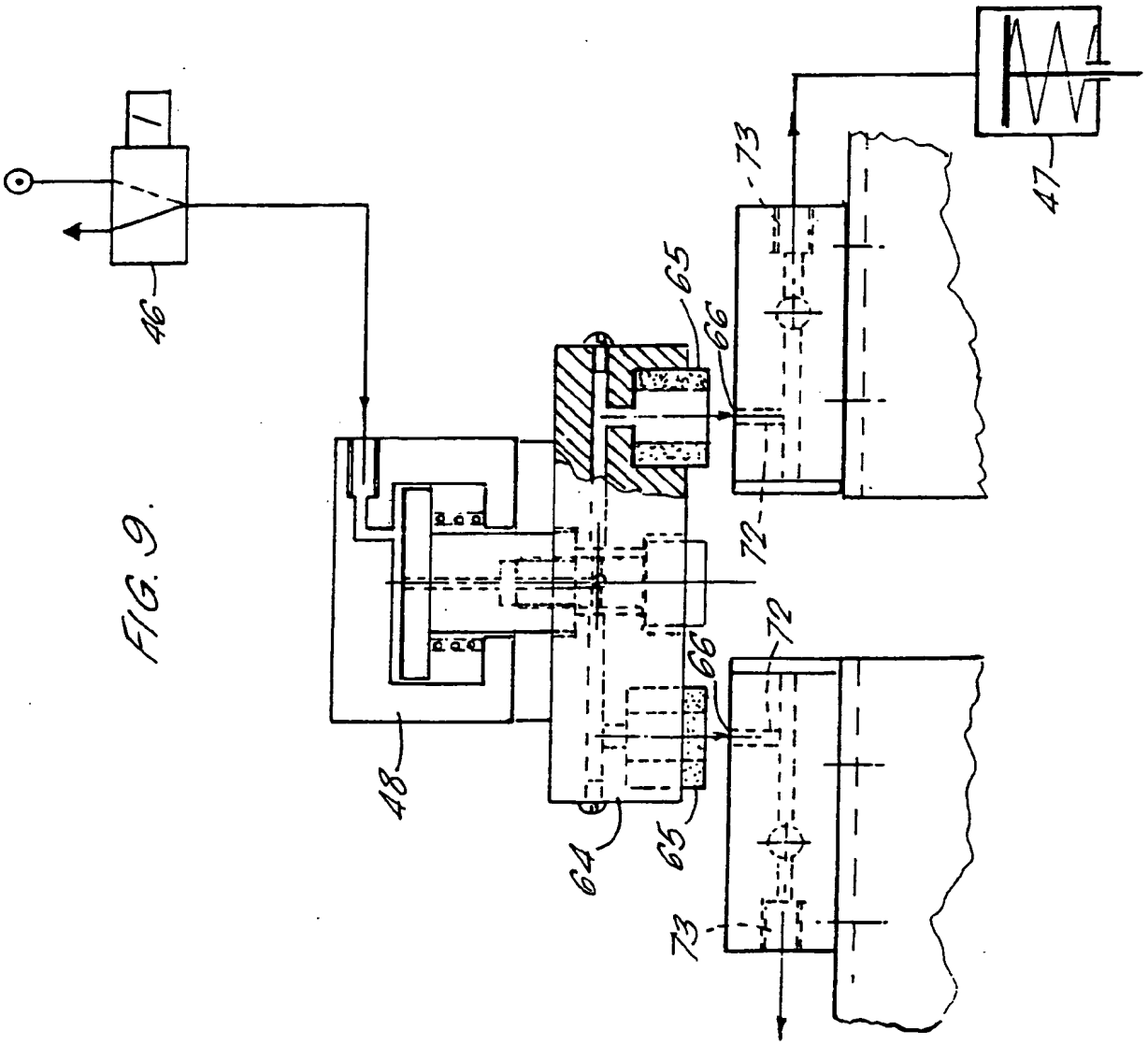


FIG. 11.

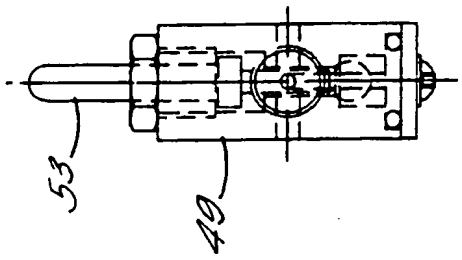
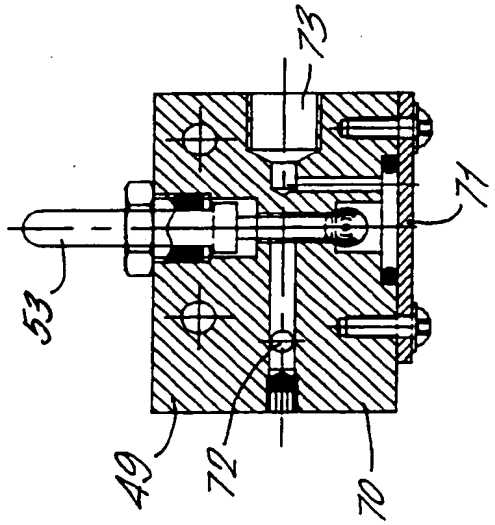


FIG. 10.



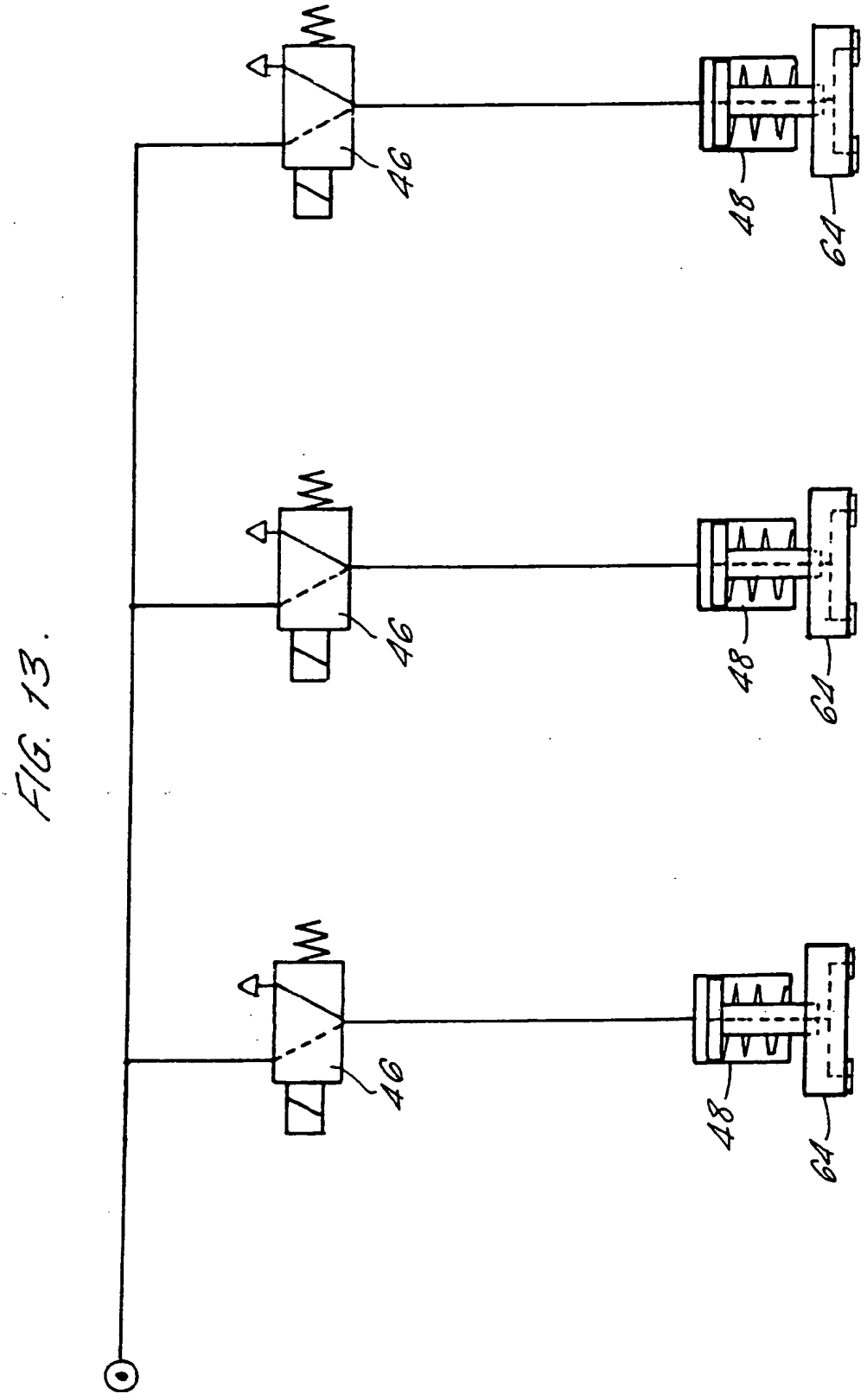


FIG. 13.

FIG. 14.

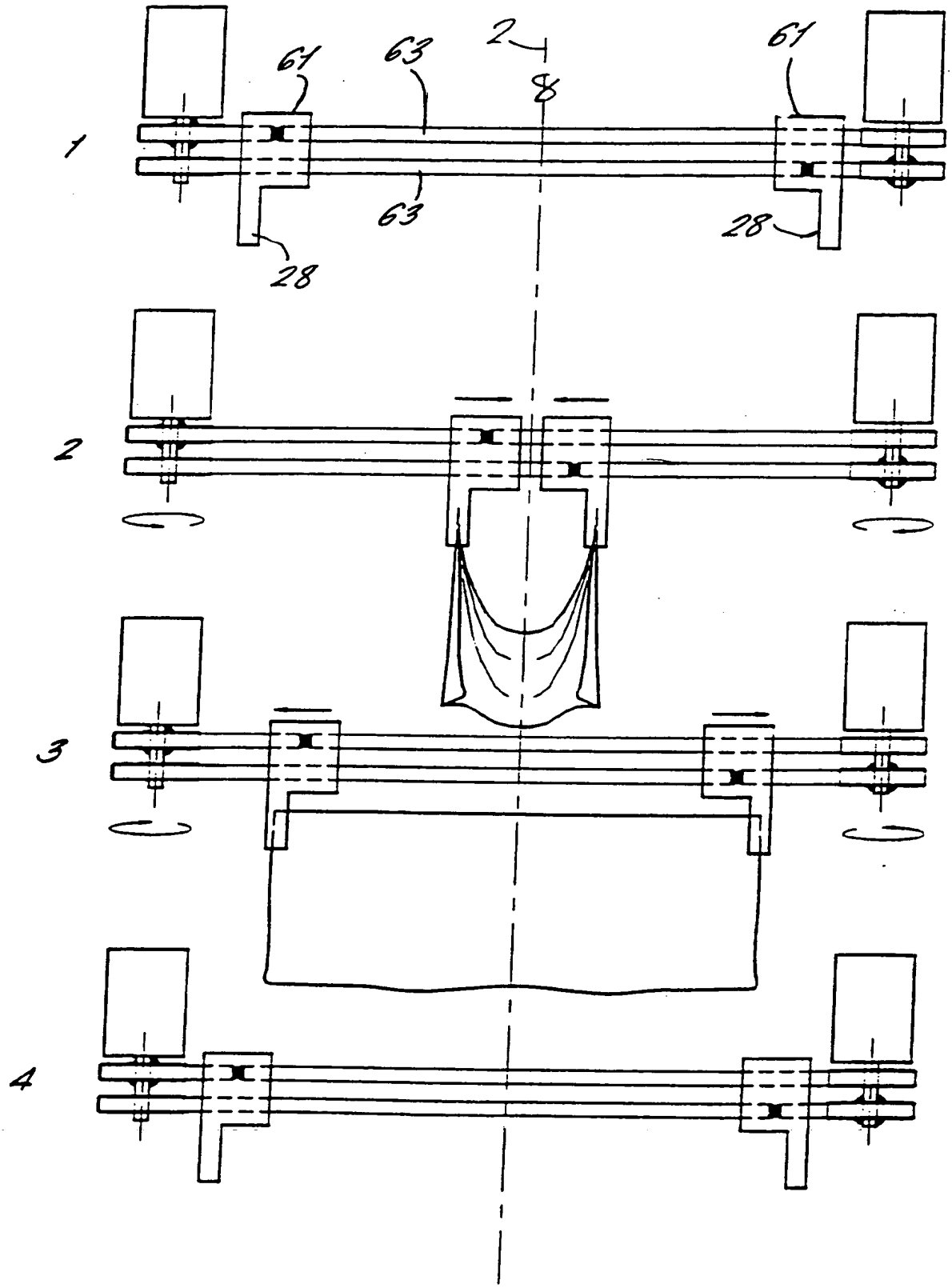


FIG. 15.

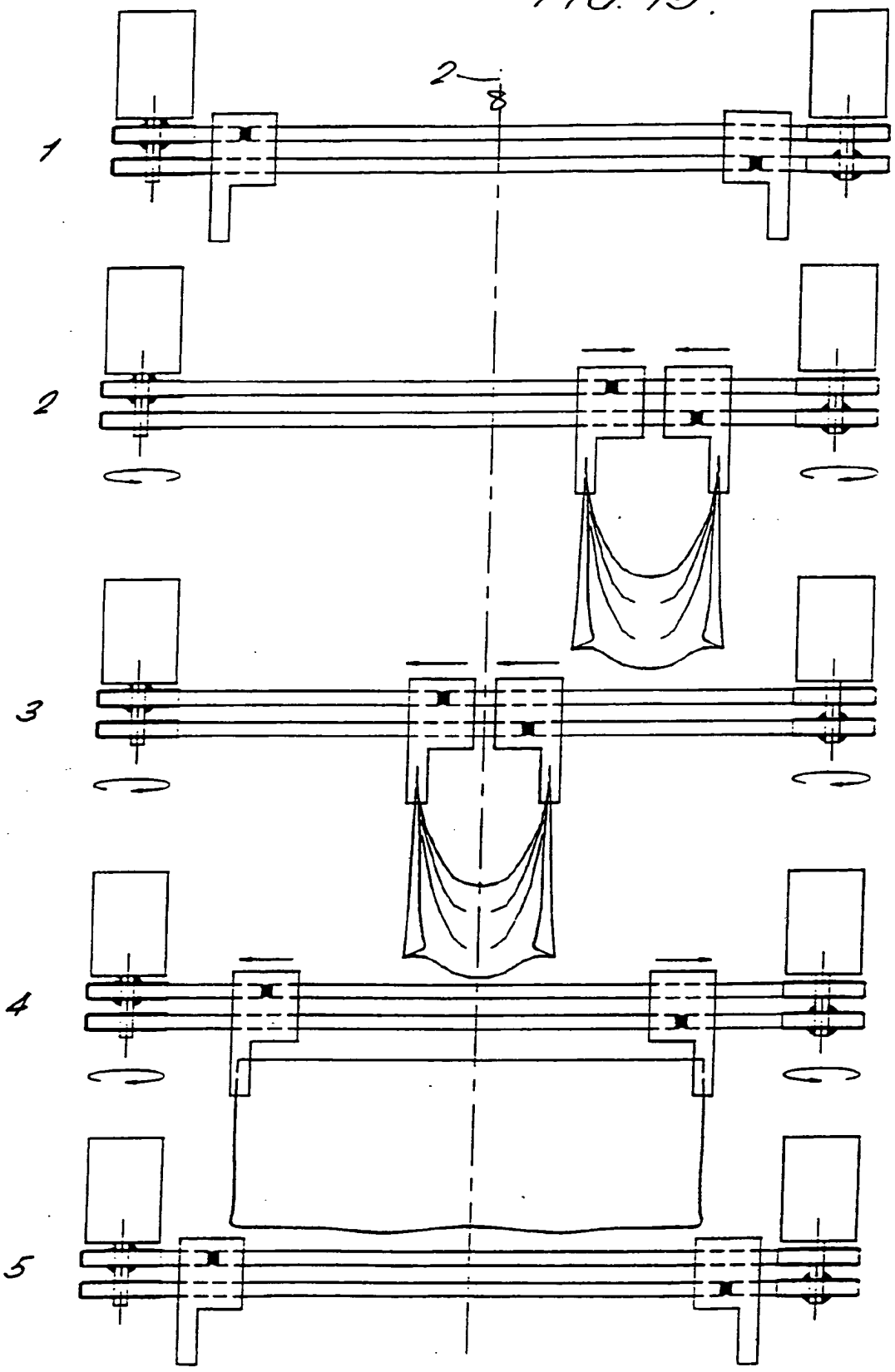


FIG. 16.

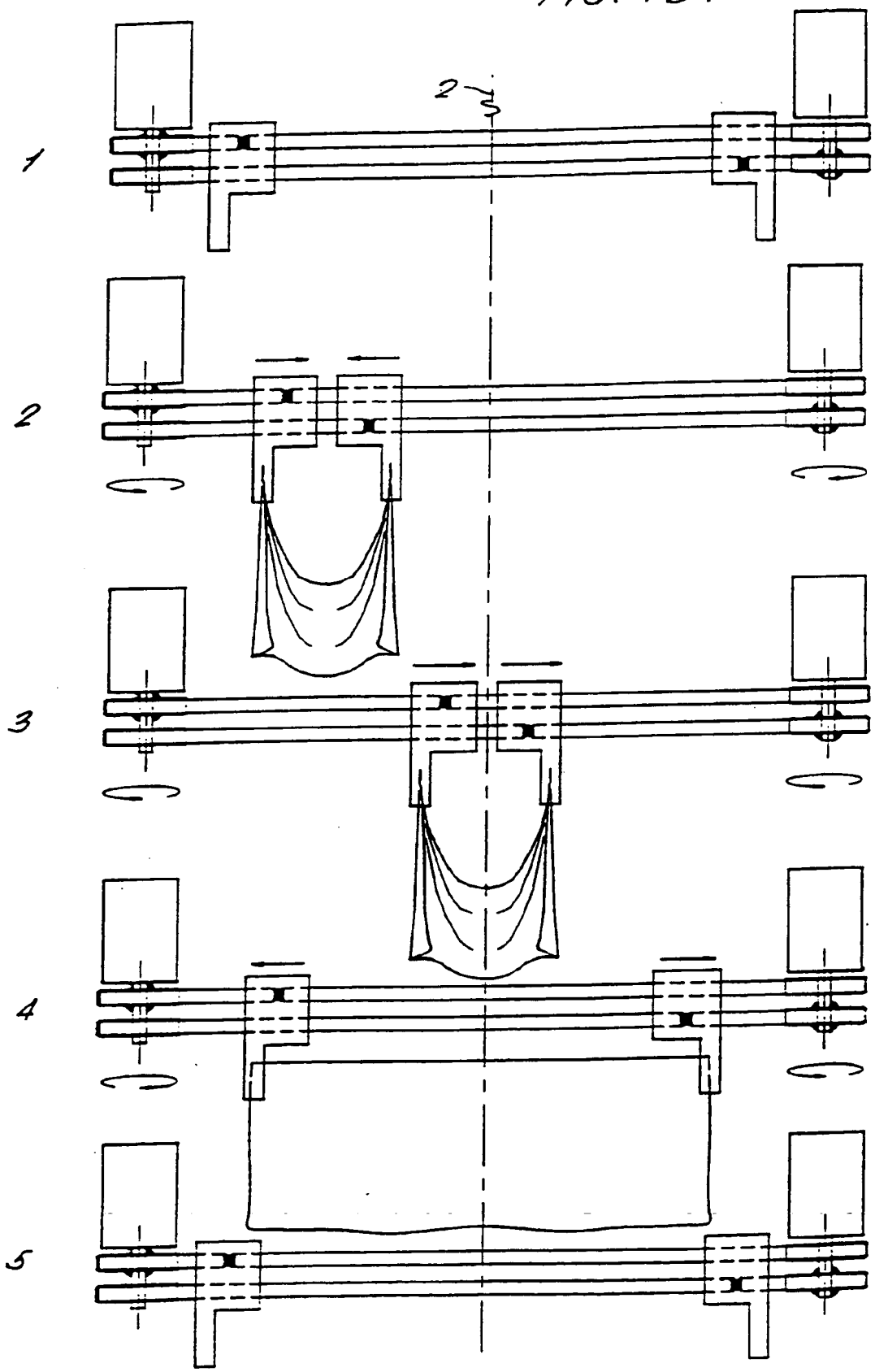


FIG. 17

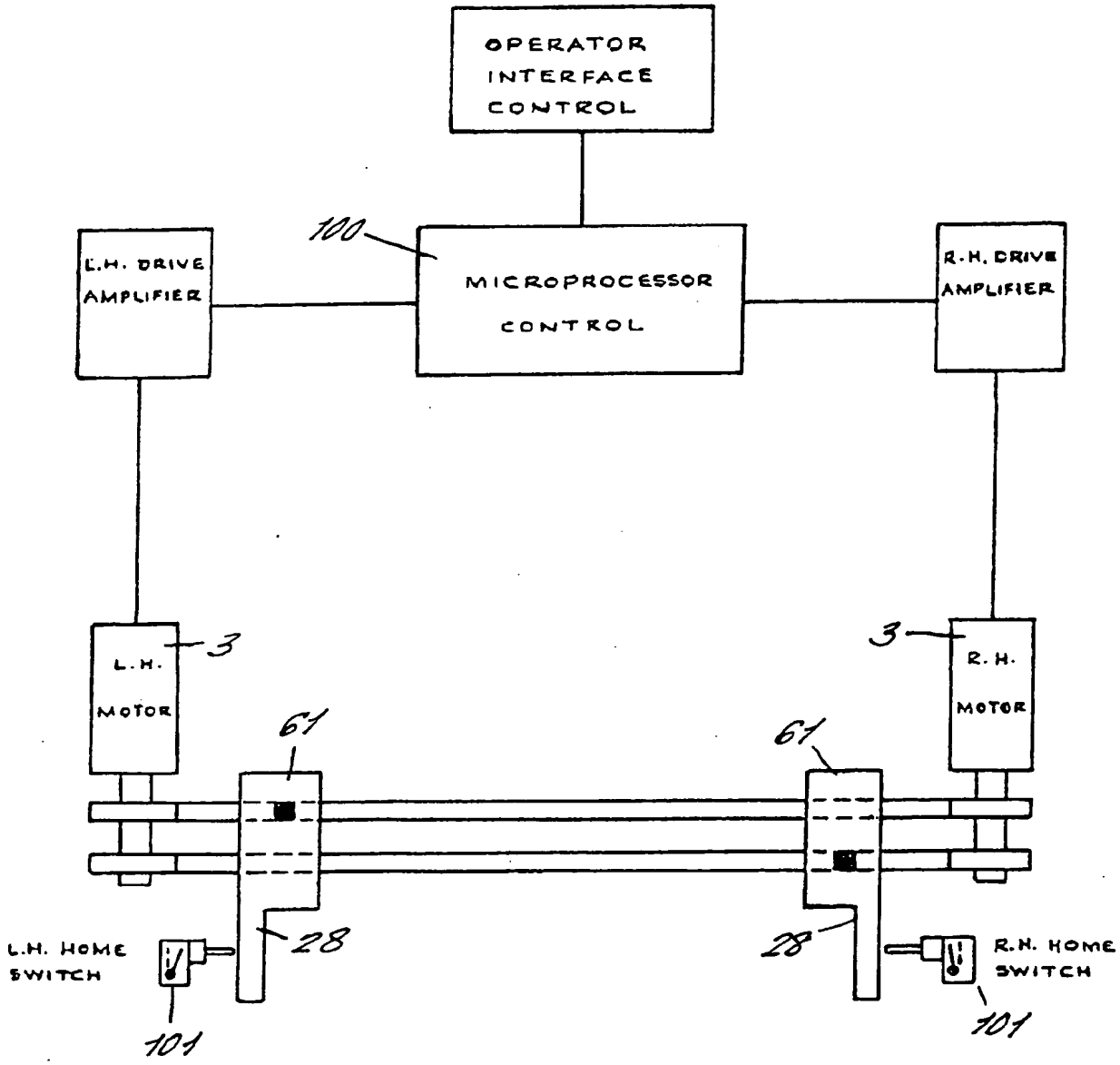

OPERATOR INTERFACE CONTROL
100
MICROPROCESSOR CONTROL
L.H. DRIVE AMPLIFIER
R.H. DRIVE AMPLIFIER
L.H. MOTOR
3
R.H. MOTOR
3
61
61
28
28
L.H. HOME SWITCH
R.H. HOME SWITCH
101
101

FIG. 18.

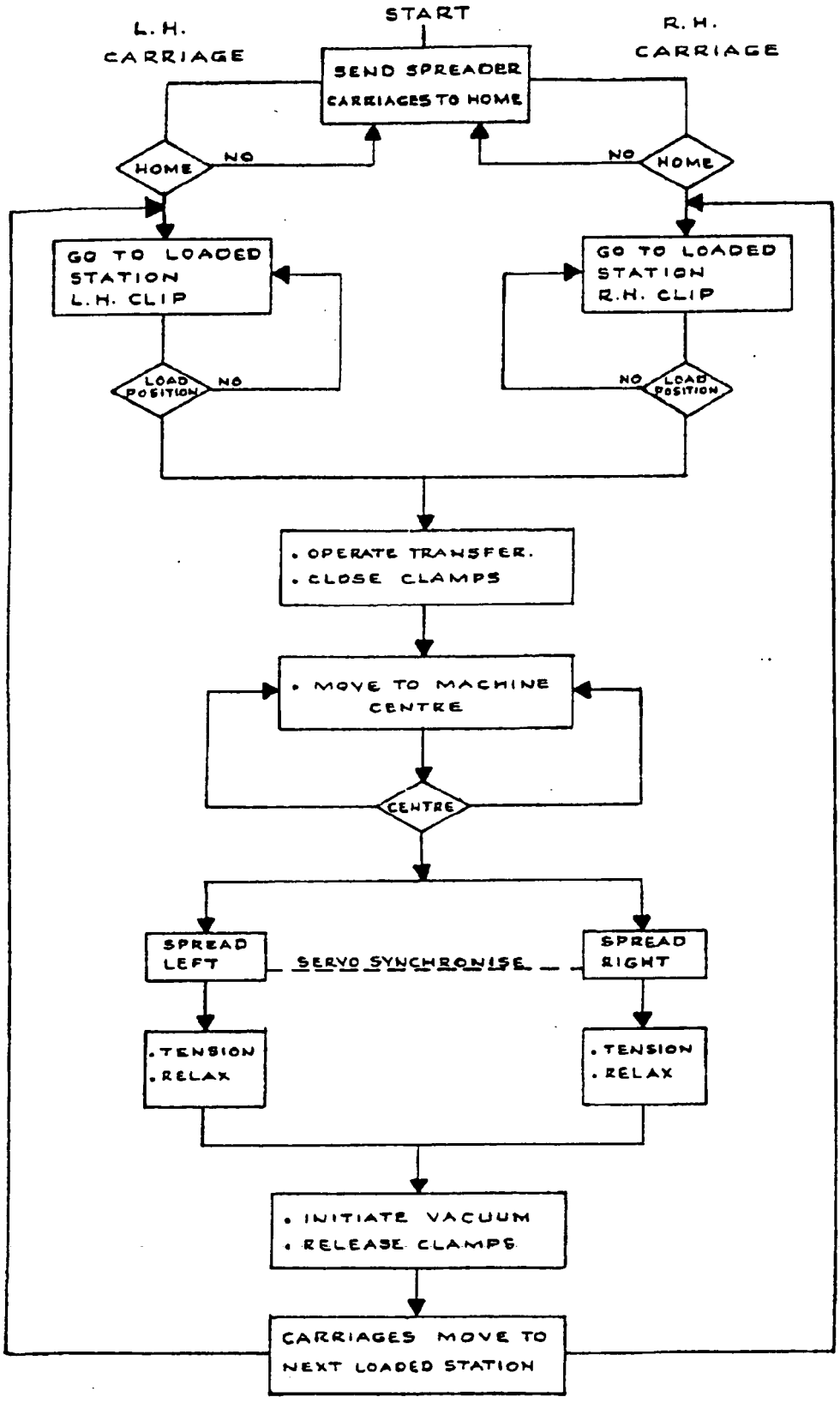
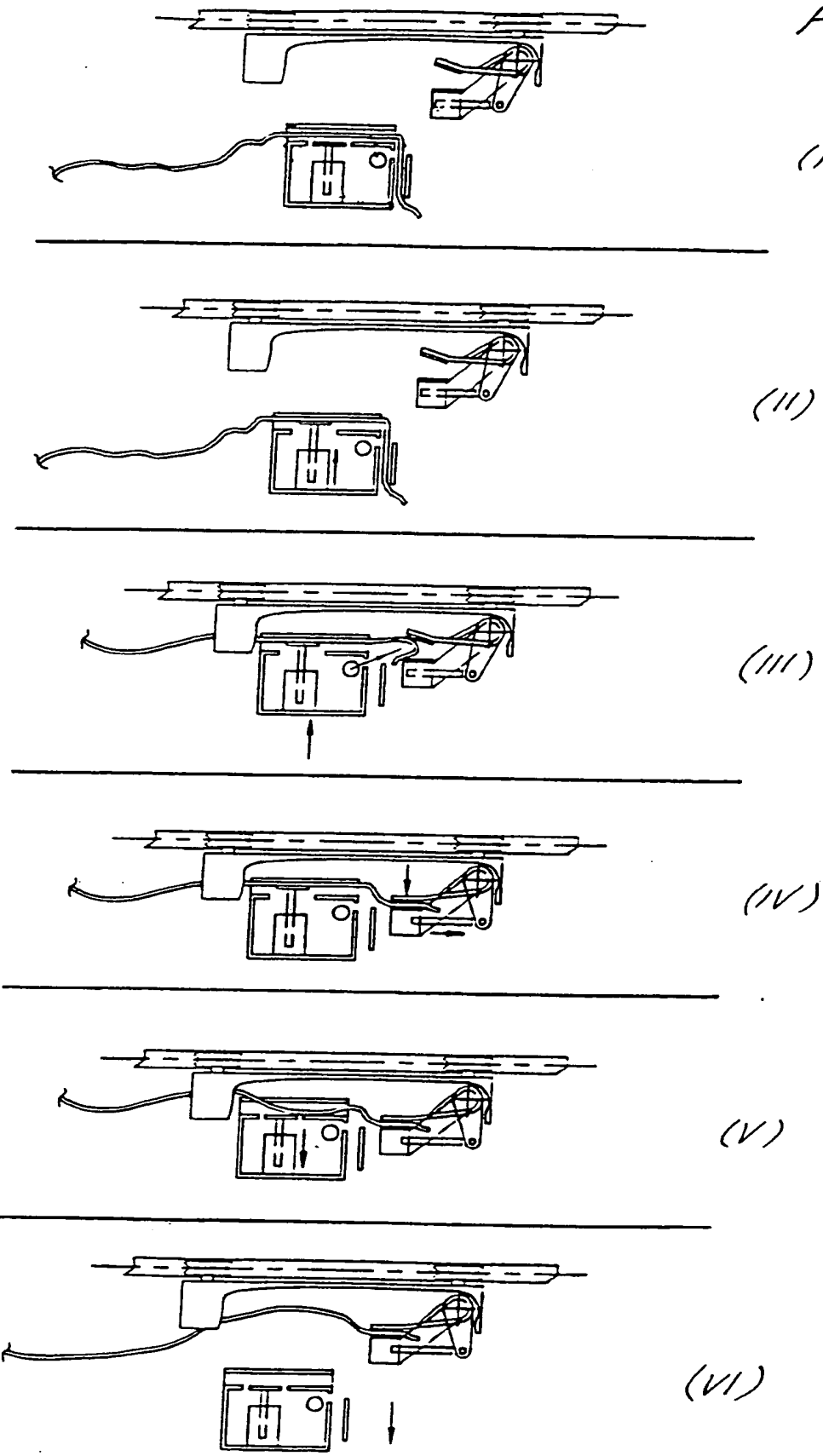


FIG. 19.



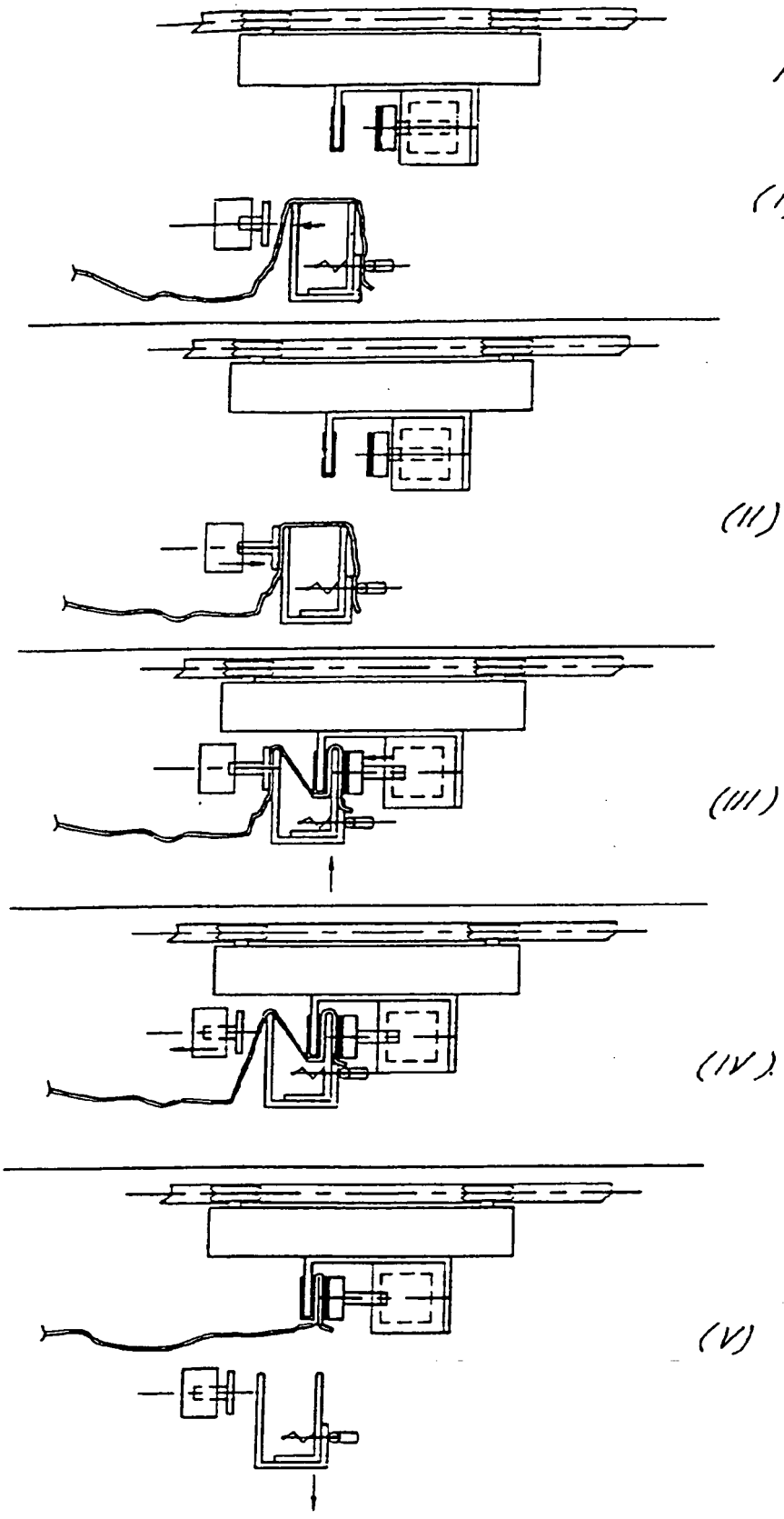
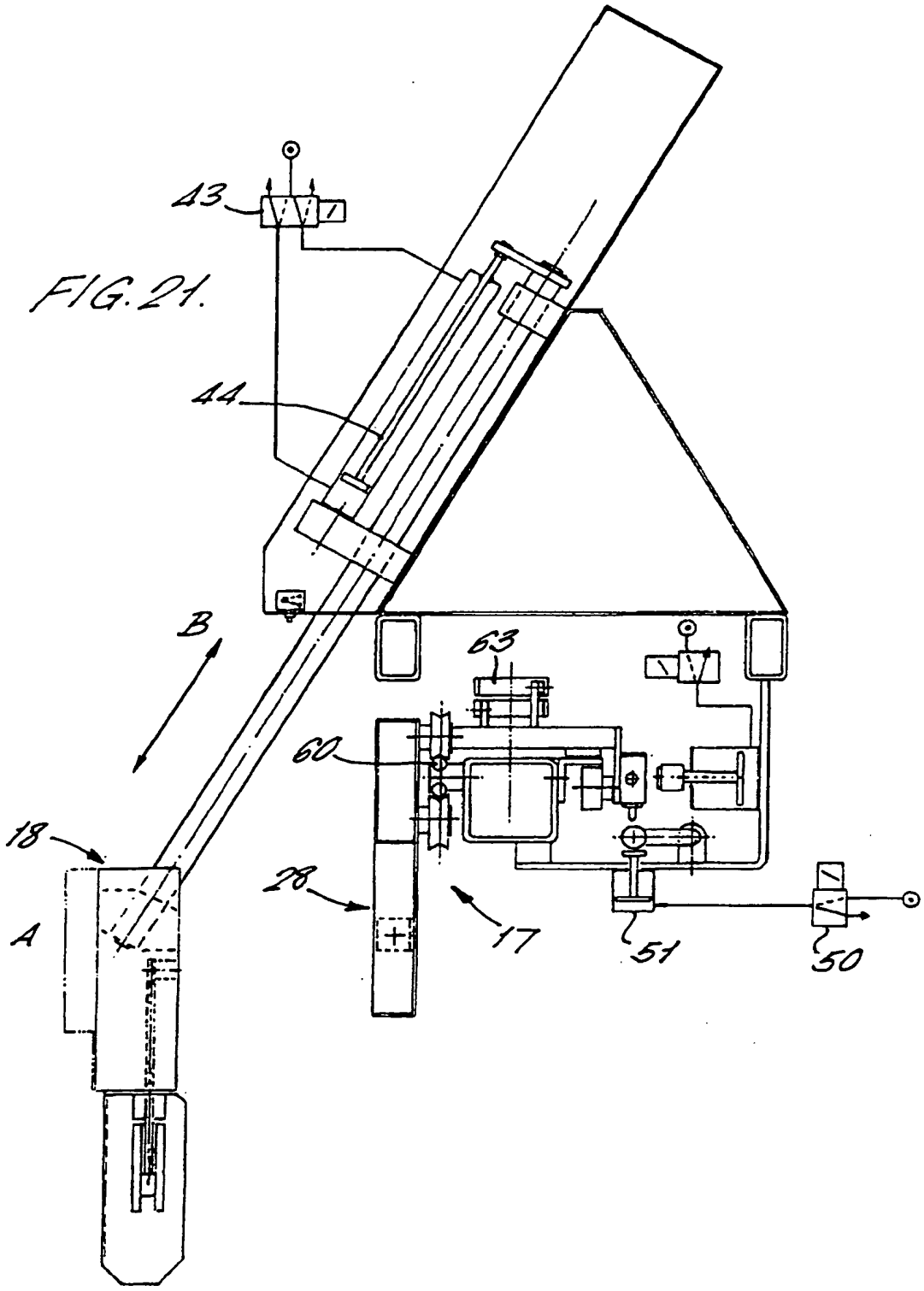


FIG. 20.

FIG. 21.



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 30 5898

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	DE-U-8 813 421 (HERBERT KANNEGIESSER GMBH + CO.) * page 11, line 23 - page 19; figures *	1,2,5,6, 8,14,21 10,13	D06F67/04
A	US-A-4 106 227 (JENSEN CORPORATION) * claims; figures *	1,3,4,14	
A,D	GB-A-1 169 513 (HENRY JOHN WEIR) * claims; figures *	1,3	
A	GB-A-2 098 632 (MARTIN KANNEGIESSER) * claims; figures *	1,14,15	
A,D	US-A-4 991 326 (H. J. WEIR) * abstract; figures *	17,19, 20,23	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 OCTOBER 1992	COURRIER G.L.A.

EPO FORM 1503 03.82 (P0401)

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document